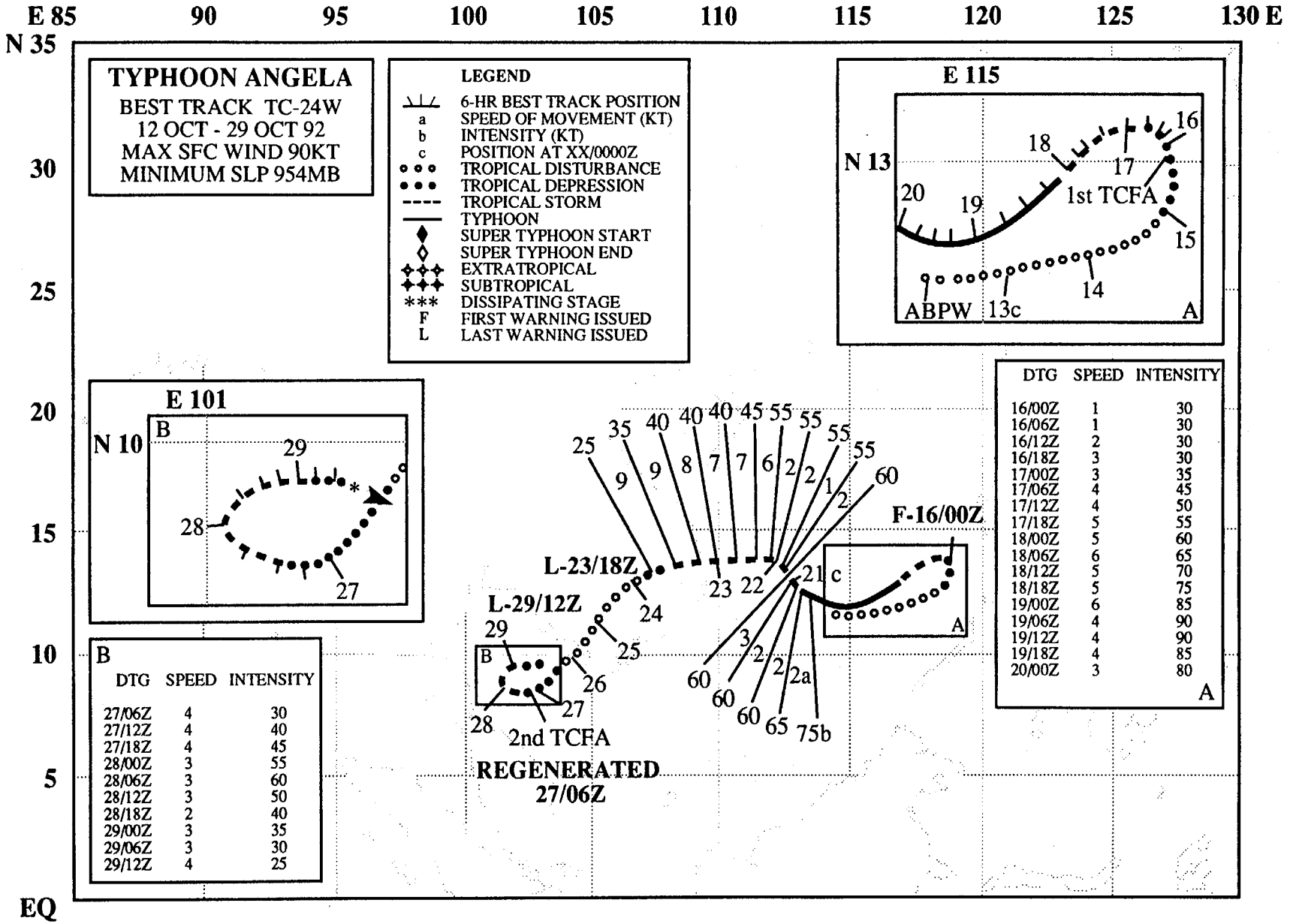
E 85
90
95
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105
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N 35
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EQ
TYPHOON ANGELA
BEST TRACK TC-24W
12 OCT - 29 OCT 92
MAX SFC WIND 90KT
MINIMUM SLP 954MB
LEGEND
6-HR BEST TRACK POSITION
a SPEED OF MOVEMENT (KT)
b INTENSITY (KT)
c POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
*** DISSIPATING STAGE
F FIRST WARNING ISSUED
L LAST WARNING ISSUED
E 115
N 13
16
17
18
19
20
1st TCFA
15
14
ABPW
13c
A
E 101
N 10
B
29
28
27
B
DTG SPEED INTENSITY
27/06Z 4 30
27/12Z 4 40
27/18Z 4 45
28/00Z 3 55
28/06Z 3 60
28/12Z 3 50
28/18Z 2 40
29/00Z 3 35
29/06Z 3 30
29/12Z 4 25
25 35 40 40 40 45 55 55 55 55 60
9 9 8 7 7 6 2 2 1 2
L-23/18Z
24
23 22 21 c
F-16/00Z
A
L-29/12Z
29
B
25
26
27
28
2nd TCFA
REGENERATED
27/06Z
60 60 60 65 75b
3 2 2 2a
DTG SPEED INTENSITY
16/00Z 1 30
16/06Z 1 30
16/12Z 2 30
16/18Z 3 30
17/00Z 3 35
17/06Z 4 45
17/12Z 4 50
17/18Z 5 55
18/00Z 5 60
18/06Z 6 65
18/12Z 5 70
18/18Z 5 75
19/00Z 6 85
19/06Z 4 90
19/12Z 4 90
19/18Z 4 85
20/00Z 3 80
A

TYPHOON ANGELA (24W)

I. HIGHLIGHTS

The third of eight significant tropical cyclones to form in October, Angela developed in the South China Sea, moved east, reversed course and struck southern Vietnam, crossed southern Indochina, reintensified to a severe tropical storm in the Gulf of Thailand, tracked through a clockwise loop, and finally dissipated over water. While anchoring the western end of a monsoon trough, Angela became part of a four storm outbreak along with Brian (25W), Colleen (26W) and Dan (27W).

II. TRACK AND INTENSITY

Developing in the South China Sea in the monsoon trough that trailed southwestward from Super Typhoon Yvette (23W), the tropical disturbance, which became Angela, was first mentioned on the 120600Z October Significant Tropical Weather Advisory as an area of persistent convection. The tropical disturbance drifted slowly eastward along the edge of the deep southwesterly flow on the south side of the trough. On 15 October, as Yvette (23W) reached the axis of the subtropical ridge and began recurving to the northeast, the vertical wind shear over the disturbance weakened. As a consequence, the disturbance began to intensify, prompting JTWC to issue a Tropical Cyclone Formation Alert (TCFA) at 151830Z, and the first warning at 160000Z.

With Yvette's (23W) departure from the tropics, the monsoon trough moved south to reestablish itself east-southeastward across the central Philippines and into the Caroline Islands. As this shift occurred, the orientation of the trough axis changed from southwest/northeast to east-southeast/west-northwest, and Tropical Depression 24W reversed course and slowly headed westward. Angela's further consolidation required JTWC to upgrade the 170000Z warning to tropical storm intensity, and later typhoon intensity at 180000Z.

By 18 October, Angela also became the anchor-low for the western end of the monsoon trough that extended eastward through Colleen (26W), Brian (25W), and into the southern Marshall Islands. As the northeasterly winds aloft increased, Angela's low-level circulation became partially exposed to the east of the deep central convection, and forecasters downgraded the typhoon to a tropical storm at 201800Z. Further weakening ensued as the tropical cyclone moved westward into southern Vietnam (3-24-1). This necessitated another downgrade to a tropical depression and, six hours later, a final warning at 231800Z, as the low-level center dissipated over land.

For the next four days the mid-level remnants of Angela persisted without central convection and moved southwestward across southern Indochina. Upon entering the Gulf of Thailand on 27 October, the cyclonic circulation slowly regained its convection and deepened through the lower troposphere. Another TCFA was issued by JTWC at 270330Z, and immediately followed by a regenerated warning on 270600Z. As the compact circulation of Angela intensified and began to execute a clockwise loop in the central Gulf of Thailand, it moved through a group of manned gas platforms which provided invaluable surface and radar reports. The reports from the Satun Station gas platform (9.3°N 101.4°E) proved to be important for describing the passage of this midget tropical cyclone. The 280240Z depiction of the Satun Station radar display in Figure 3-24-2 and the wind reports (Figure 3-24-3), which included the 70 kt (36 m/sec) peak at 280440Z, prompted JTWC forecasters to upgrade the 280600Z warning to typhoon intensity. Later, during post analysis, this 6-hour maximum at typhoon intensity was reduced to a severe tropical storm intensity of 60 kt (31 m/sec) based on the relatively high surface pressures near 1000 mb, other wind reports in the area, and the determination that the 70-kt

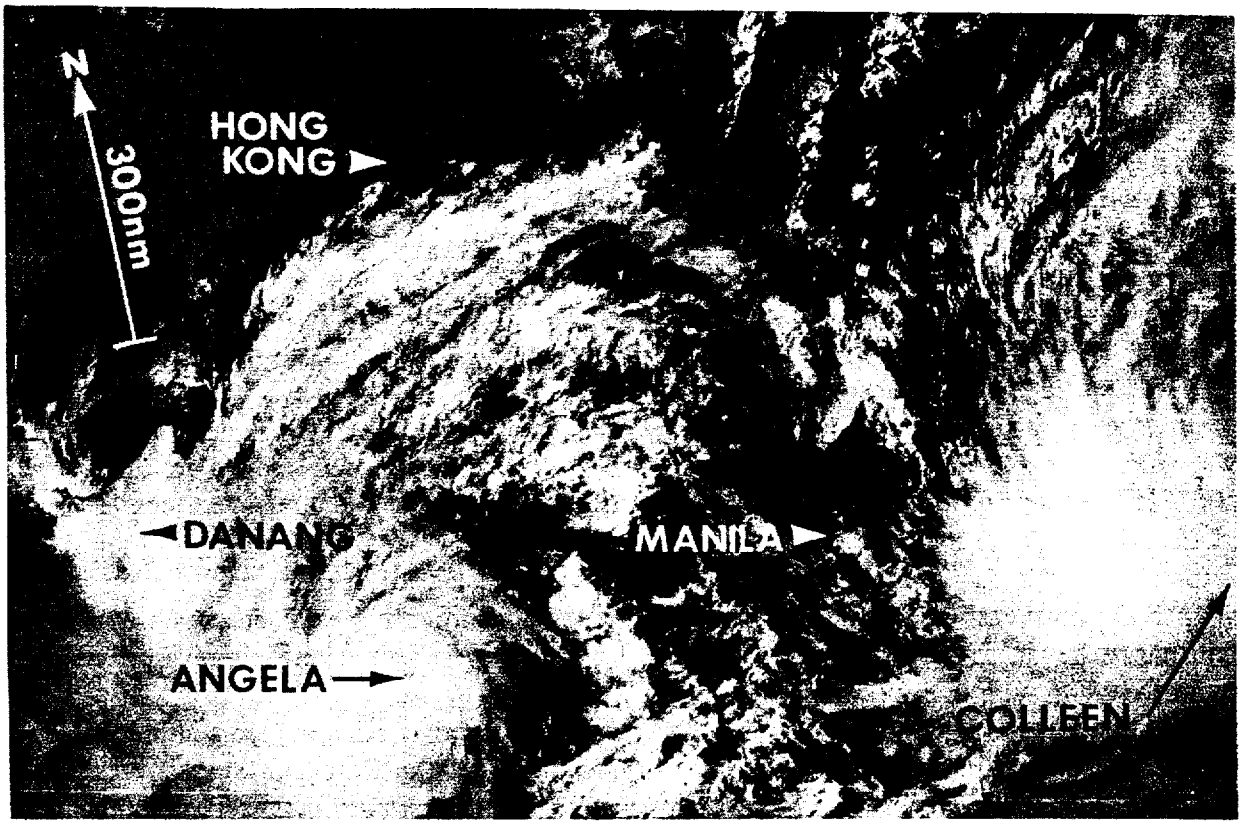

Figure 3-24-1. Twelve hours after being downgraded to a tropical storm, Angela churns westward across the South China Sea towards southern Vietnam. Part of Colleen's (26W) dense overcast is visible at the lower right of the picture (210122Z October DMSP visual imagery).

wind report was averaged over a period of less than one minute. After this peak, Angela's organization and intensity rapidly weakened due to upper-level wind shear until the "second" final warning was issued by JTWC at 291200Z as the tropical cyclone dissipated over the Gulf.

III. FORECAST PERFORMANCE

The overall mean track forecasting errors showed that JTWC 's performance was better than average and showed skill in comparison with CLIPER, which is used as the baseline for performance. With overall errors of 80, 145 and 180 nm (145, 265 and 330 km) at 24, 48 and 72 hours, respectively, JTWC bettered CLIPER's performance by 30%. Initially, due to the relatively weak steering flow affecting Angela, track forecast guidance was poor. However, once Angela began to move westward toward the Vietnamese coast, most forecast aids did well. Later, in the Gulf of Thailand, the track guidance tended to track Angela across the Malay Peninsula and into the Bay of Bengal.

IV. IMPACT

In southern Vietnam, at least seven people were reported missing and 17 others injured. Angela's torrential rains caused extensive flooding, loss of crops, livestock and fishing boats, and damage to rail lines and roads. In Thailand, there were two fatalities and seven people were reported missing. Heavy rains and flooding resulted in at least 600 houses being destroyed. Angela posed a significant threat in the Gulf of Thailand, where manned gas platforms were forced to evacuate as Angela intensified and moved into the area. All platform evacuations proceeded smoothly and no reports of damage or injuries were received.

The weather and radar reports from the manned gas platforms in the Gulf of Thailand presented forecasters at JTWC a unique opportunity to gather data on the rainbands and compact wind field associated with a very small tropical cyclone.

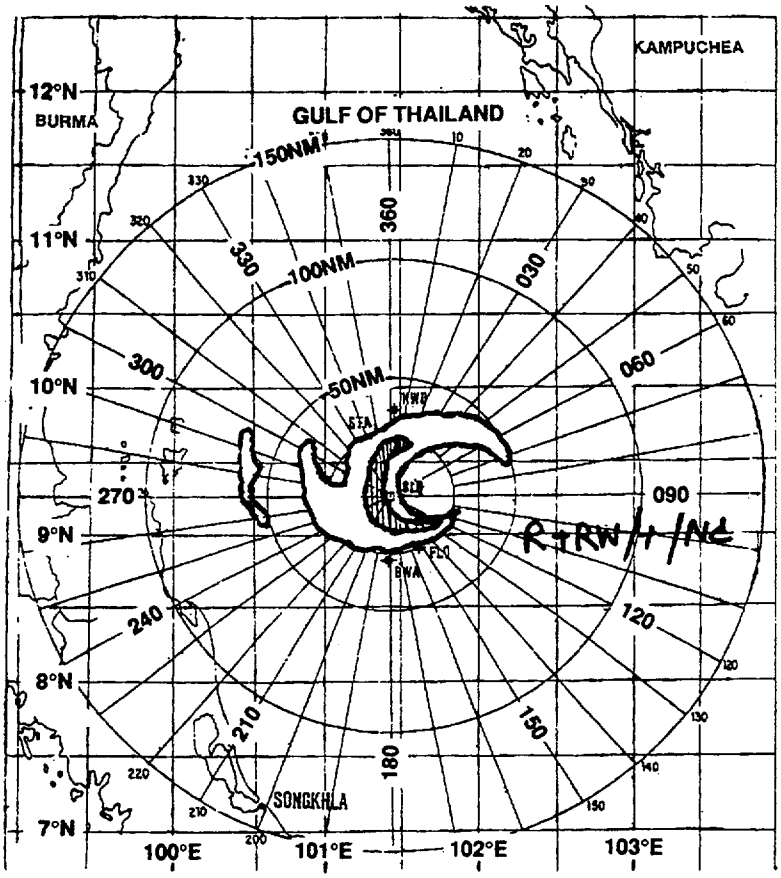

Figure 3-24-2. Angela's tightly curved rainbands as seen on radar from the Satun Station gas platform located at 9.3°N and 101.4°E (radar depiction courtesy of UNOCAL Thailand, Ltd.).

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Time (Z)	00	01	02	03	04	05	06	07
Pressure (mb)	1002.3	1001.5	m	m	998.1	1000.1	1001.9	1000.9
Wind (kt)								
Wave Height (m)	5.2	5.3	m	m	6.2	5.0	5.0	3.9

Figure 3-24-3. Wind reports which are plotted to the nearest hour for the Satun Station gas platform (9.3°N, 101.4°E) for the 24-hour period commencing 270900Z. Angela's passage close by the platform is reflected by the storm force winds, wind shift, and lower pressures from 280300Z to 280600Z. The lowest pressure reported was 998.1 mb at 280400Z, however, the pressure an hour earlier, which was missing from the data set, could have been considerably lower (data courtesy of Uncope Thailand, Ltd.).